

REMARKS/ARGUMENTS

Drawing Objection

Figure 1 was objected for improperly identifying the calcium chloride slurry as calcium fluoride slurry. Applicant inadvertently omitted the replacement drawing sheets in the prior response, and now submits the replacement drawing. The slurry is now properly identified as calcium fluoride/chloride slurry. The examiner's objection should be overcome.

35 USC § 112, second paragraph

Claims 1, 3, 7, 9, and 13 were rejected under 35 USC § 112, 1st as being indefinite. As the claims were canceled, the rejection should therefore be moot.

35 USC § 103

The rejection of Claims 1, 3, 7, and 9 under 35 USC § 103 as being obvious over JP 11-130427 in view of Johansing (U.S. Pat. No. 5,705,140) was maintained. Claims 1, 3, 7, and 9 were canceled, and the rejection should therefore be moot.

The rejection of Claim 13 under 35 USC § 103 as being obvious over JP 11-130427 and Johansing as applied above in further Ohmi et al. (U.S. Pat. No. 5,362,461) was also maintained. Claim 13 was canceled, and the rejection should therefore be moot.

New Claims - Support

Support for the new claims can be found as indicated in the brackets:

14. A method of treating an effluent containing at least one of hydrofluoric acid and fluoride to thereby recover calcium fluoride, the method comprising: (**support: Abstract, [0001]**) forming a crystallization solution by combining the effluent with an aqueous solution of calcium chloride, and adjusting or maintaining the pH of the crystallization solution such that solubility of calcium fluoride is at least 0.05%; (**support: [0034], Examples 1-10**)

allowing calcium chloride crystals to form in the crystallization solution, wherein the calcium chloride crystals have a purity of at least 98% and an average particle size of between 5-300 μm ; (**support: [0034], [0057], Examples 1-10**)

separating the calcium chloride crystals from the crystallization solution to so produce a mother liquor; (**support: [0057], Examples 1-10**)

increasing the pH in the mother liquor and adding a calcium compound to thereby form additional calcium chloride crystals and a depleted solution, wherein the pH and a quantity of the calcium compound is effective to reduce the fluoride concentration in the depleted solution; (**support: [0039], [0062], Examples 1-10**)

removing the additional calcium chloride crystals and remaining calcium compound from the depleted solution to thereby regenerate the aqueous solution of calcium chloride. (**support: [0062], [0063], Examples 1-10**)

15. The method of claim 14 wherein the pH is adjusted such that solubility of calcium fluoride is at least 0.2%. (**support: [0047]**)
16. The method of claim 14 wherein the pH is adjusted such that solubility of calcium fluoride is at least 0.4%. (**support: [0047]**)
17. The method of claim 14 wherein the effluent has a fluoride concentration of at least 0.1%. (**support: [0061]**)
18. The method of claim 14 wherein the effluent has a fluoride concentration of at least 0.5%. (**support: [0061]**)
19. The method of claim 14 wherein the pH of the crystallization solution is adjusted to or maintained at pH2 or lower. (**support: [0034]**)
20. The method of claim 14 wherein the fluoride concentration in the depleted solution is reduced to no lower than 10 ppm. (**support: [0039]**)
21. The method of claim 14 wherein the calcium chloride crystals in the crystallization solution have an average particle size of at least 30 μm . (**support: [0056]**)

22. The method of claim 14 wherein the step of allowing calcium chloride crystals to form in the crystallization solution is performed at a temperature of between 30-90 °C. (**support: [0056]**)
23. The method of claim 14 further comprising a step of washing and drying the calcium chloride crystals, and wherinc the calcium chloride crystals after washing and drying have a purity of at least 99%, have loss on ignition of less than 0.3%, and a chlorine content of less 0.05%. (**support: [0057]**)
24. The method of claim 14 wherein the mother liquor has a residual calcium fluoride content of at least 0.05%. (**support: [0059]**)
25. The method of claim 14 wherein the mother liquor has a residual calcium fluoride content of between 0.05 and 2%. (**support: [0059]**)

New Claims - Allowability

It is pointed out that the new claims even more clearly delineate the inventive subject matter over the cited art. More specifically, it should be appreciated that the inventive process relies on two calcium fluoride precipitation steps: A first, high-purity and large-crystal step at low yield, and a second, lower-purity and smaller crystal step. Such dual mode was neither taught nor suggested in the art.

Moreover, it must be stressed that the conditions for the first crystallization step are entirely contrary to conventional wisdom in the art of fluoride removal as that step is performed under conditions where the solubility of the product that is to be removed is very high. Indeed, conventional processes (see e.g., [0041]) are performed at solubilities for calcium fluoride that are 25 times higher than the solubilities for the inventive process. Clearly, the POHISTA is concerned with removal of CaF₂ and thus will attempt to optimize precipitation conditions. Unexpectedly, the inventors discovered that at unfavorable crystallization conditions the purity and size of the CaF₂ crystals significantly improved. Additionally, the inventors discovered that by adding a calcium containing neutralizing agent, the residual fluoride can be effectively

removed to levels as low as 10 ppm. Thus, only by use of the inventive subject matter can two normally competing processes (high yield process and large crystal size at high purity) achieved.

These advantages were neither recognized/appreciated, nor contemplated in the cited art. Consequently, the new claims should be allowable over the cited art.

Request for Allowance

In view of the present amendments and arguments, the applicant believes that all claims are now in condition for allowance. Therefore, the applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted,
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